Who can forget the famous and stinging characterization of that tutor in Magdalen College whom Gibbon's caustic pen has embalmed in eternal disgrace, one Dr. ———, of whom Gibbon said, 'he well remembered that he had a salary to receive, and he only forgot that he had a duty to perform.' I have always been sorry that Dr. ——— was a teacher and glad that he was not a scientific man. President Hadley, I think, struck the right note when he cautioned young men not to ask themselves 'How much can we get out of college?' but rather, 'How much of ourselves can we put into it?' Science, like religion, demands of her votaries lofty sacrifices and personal devotion, and if they are public servants their debt to her is always not less but more.

WM. T. SEDGWICK.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

THE ALBANY MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA.

I.

THE thirteenth annual meeting of the Geological Society of America was held in Albany on December 27, 28 and 29, 1900. The fellows were called to order by the retiring President, Dr. George M. Dawson, Director of the Geological Survey of Canada, at 10 A.M. on Thursday, in the chapel of the Albany Academy. A very gratifying number of members was present and during the sessions from 50 to 60 were in attendance. All felt the significance of meeting in the city where stratigraphical geology received its greatest single impetus in America and where the classification of most of the Paleozoic was chiefly worked out. Memories of James Hall were in all minds and frequent reference was made to the late venerable State Geologist, first President of the Society.

At the opening meeting brief addresses of welcome were made by Dr. F. J. H. Merrill, State Geologist, and by Dr. J. M. Clarke, State Paleontologist. The Council then presented its written report, which showed the Society to be in a very flourishing condition. During the year one fellow, Mr. Franklin Platt, has died. The present enrolment is 248, and the financial condition is gratifying. The following officers were declared elected:

President, Charles D. Walcott, Washington, D. C.; *First Vice-President*, N. H. Winchell, Minneapolis, Minn.; *Second Vice-President*, S. F. Emmons, Washington, D. C.; *Secretary*, H. L. Fairchild, Rochester, N. Y.; *Treasurer*, I. C. White, Morgantown, W. Va.; *Editor*, J. Stanley Brown, Washington, D. C.; *Librarian*, H. P. Cushing, Cleveland, O.; *Councillors:* Samuel Calvin, Iowa City, Ia.; A. P. Coleman, Toronto, Can.

A memorial of Franklin Platt, prepared by Persifor Frazer was then read by W. M. Davis, and at its conclusion the reading of scientific papers was immediately taken up.

Experimental Work on the Flow of Rocks recently carried out at the MacGill University, Montreal: FRANK D. ADAMS.

This paper gave the results of an investigation in which the effects of very heavy pressure on rocks were studied with a view to ascertaining how the gigantic movements which geologists observe in the strata of the earth's crust have taken place.

Marble was the rock on which most of the work was carried out, but harder rocks such as granite are now being studied as well. Small columns of marble an inch in diameter and an inch and one-half high were carefully turned, polished and then very accurately fitted into heavy wrought iron tubes constructed on the plan of heavy ordnance, by wrapping strips of wrought iron around a core of soft iron and welding the whole together. The core of iron was then bored out and the marble substituted for it. Heavy steel pistons were fitted into each end of the tube, and the rock was thus submitted to very high pressures, often for several months continuously, in espe-

cially constructed machines capable of developing pressures reaching nearly 100 tons to the square inch.

Under high pressures the marble was found to flow, bulging out the iron tube that enclosed it on all sides. When the iron tube was cut away a solid block of marble was obtained, which had completely altered its shape. It was found, however, that the marble in these cases was only about half as strong as the original rock.

Other columns of marble were then heated to temperatures of 300 C. and 400 C. and while thus heated the pressure was applied as before. Under these conditions the rock was found to flow readily and to retain its strength much better, being nearly as strong as the original rock.

In the third series of experiments the marble was not only heated to the temperatures before mentioned, but at the same time water under a pressure of 460 pounds to the square inch was forced through it while it was being compressed. Under these conditions, the marble after being molded was found to be as strong as it was originally.

A microscopical study of the structure of the deformed marble shows that in these two latter cases the crystalline grains composing the marble had glided on one another.

This structure is exactly the same as that which is produced in a billet of iron when it is heated and then hammered or rolled, or in a button of gold when flattened in a vise, so that the marble *flows* just as any metal does when submitted to pressure, except that under the ordinary conditions at the surface of the earth the brittleness of the marble causes it to break before the flow point is reached. In the depths of the earth, however, being hemmed in by other rocks, it flows as in the experiments.

The paper was elaborately illustrated by specimens and by many lantern slides, showing the machines employed, as well as the marble before and after compression. They also illustrated its structure as compared with that of various rocks found in the earth's crust and with hammered iron.

In discussion B. K. Emerson asked (1) whether the cylinders of marble contained any water before they were put into the machine; (2) if any schistosity resulted, and, if so, in what way it was related to the optical properties of the calcite grains; (3) if the marble rebounded on the release of pressure.

J. E. Wolff inquired whether the water that was forced in passed around or through the cylinder of stone, and if solution played any part.

G. K. Gilbert asked if the speaker could draw a parallel between the pressures employed and the depths within the earth corresponding to them.

In reply Professor Adams stated (1) that the cylinders of marble were kept in a perfectly dry laboratory, and that while no determinations of their content of water had been made, they were practically dry when put in the machine; (2) he had noted no rebound. The marble was first compressed and then accommodated itself to the pressure by flowage; (3) he had been unable to note any effects of solution as a result of the entrance of the water. The results were the same with or without the water, except that with the water the resulting disk was stronger. The water entered at the top under 460 pounds' pressure to the square inch and emerged at the bottom. The water had dissolved a little copper from the tube of entry, which was precipitated on the bottom of the marble. He could not state positively whether it went through or around, but the marble was in a bath of vapor.

J. E. Wolff suggested that waters with some dissolved dye or easily reducible salt be employed so that the last point could be

determined, and that ordinary limestone be compressed to see if it would yield marble, and that impure varieties be also used so as if possible to produce the silicates familiar as a result of metamorphism. G. K. Gilbert estimated approximately the depth which corresponded to the pressures employed. Roughly one vertical foot of rock corresponds to an increase of one pound per square inch, or one-half ton per 1,000 feet. Forty tons would therefore correspond to 80,000 feet or about 16 miles. This should be reduced somewhat, as rock is slightly heavier than the assumption, but the difference is slight.

C. D. Walcott remarked the deformation which he had observed in the rocks of the ranges in California and western Nevada, and emphasized the different behavior of brittle rocks and tough rocks, illustrating his remarks by photographs. The brittle rocks break while the tough rocks flow—the former being often driven into the latter. He suggested that Dr. Adams experiment with cylinders of varied tenacity.

G. K. Gilbert raised the point that rocks may compress slightly while they are within the elastic limit, *i. e.*, before they yield, flow or otherwise deform. He suggested the importance of determining the amount of this.

B. K. Emerson remarked the importance of allowing for the phenomena of recrystallization in interpreting the results.

Dr. Adams then thanked his colleagues for the suggestions, and stated his intention of carrying them into effect as far as possible.

The paper was felt by all to be one of the most important ever presented to the Society, and the investigations are of such significance that further results will be eagerly looked for.

Geomorphogeny of the Klamath Mountains: J. S. DILLER, Washington, D. C.

During the Neocene the Klamath mountain region of northwestern California and southwestern Oregon, by long-continued erosion, was reduced to a peneplain and the resulting marine sediments, rich in fossils and deposited along the ocean border, recorded its age. The Neocene strata were compressed and tilted, and with the Klamath peneplain and monadnocks were uplifted somewhat differentially several hundred feet above its former level. The invigorated streams in the rather long succeeding epoch of stability cut wide valleys across the peneplain to the coast, where extensive wave-cut terraces were developed. A much greater differential uplift followed, and elevated the region to an altitude of 1,200 feet to 2,000 feet, for the Klamath peneplain near the coast of 7,000 feet, and near the crest of the range causing the streams to cut deep canyons before the close of the glacial period. Near the northern border of the Klamath Mountains on the coast there has been a recent subsidence converting the lower courses of the rivers to tidal inlets.

M. R. Campbell inquired if the peneplain topography could be traced all around the mountains. The speaker replied that, while it was not everywhere present, it could often be recognized. Mr. Campbell then remarked the interesting parallelism with the Appalachians, the similar shading of plains into each other and the similar interpretation of escarpments.

As Mr. Diller had referred to great numbers of small lakes upon the elevated plain and with local 'fluviatile' rather than 'lacustrine' sedimentation, W. M. Davis suggested for the phenomena Penck's term of 'continental' sedimentation. He compared the region to the central plateau of France, and urged that under compression surface plains would warp in a general way like single strata, so that in a principal ascent of a large order there would be alternate ascents and descents of a smaller order of magnitude.

President Dawson referred to the Eocene peneplain of British Columbia that was protected from the sea during its formation by an intervening range of mountains, and was therefore subaërial in its character. He asked why the Klamath peneplain might not be explained by marine denudation. Mr. Miller replied that in the Klamath case Eocene strata were themselves trenched, and, therefore, the leveling was later; and that the entire absence of marine sediments compelled him to infer sub-aërial agencies. G. O. Smith spoke of the peneplain of Washington that lies between the Klamath mountains and British Columbia. It is post-Miocene, as it cuts Miocene strata, which have themselves been deformed, probably in the case of basalt by slipping along multitudes of joints, as suggested by Bailey Willis. G. K. Gilbert described the great Alaska peneplain, which slopes upward and eastward from the Alexander Archipelago to heights of 5,000 feet and more in the mountains. It has been vividly brought out by the photographs of the Survey of the International Boundary. He also remarked the parallelism that existed between the Pacific and Atlantic physiography. President Dawson cited mountains of the Pacific coast 7,000 feet high that have been sculptured out of uplifted plains. He sounded a note of caution, however, lest the observer be misled into believing in peneplains which had no real existence. Above a certain level degradation is abnormally active and rapid, and from this alone mountains may reach a common and deceptive level and yet not be stumps of peneplains. Mr. Gilbert, however, replied that his Alaska mountains were shouldered and therefore not open to doubt.

Origin and Structure of the Basin Ranges: J. E. SPURR, Washington, D. C.

The structure of most of the ranges which have been hitherto studied in the Great Basin region was first examined in detail, and in each case deductions were made as to the relative importance of erosion and of direct deformation, by either fault or folds, in determining the present topographic relief. Finally a general statement as to the origin of this relief is arrived at. The history of erosion in the region, and that of deformation, so far as these are known, were discussed separately; and the history and foundation of the fault hypothesis as applied to these ranges were examined. The conclusion arrived at is that the ranges in general owe their existence to the long-continued erosion of rocks folded and faulted by many successive movements, and that it is only exceptional that the folds or faults are expressed in direct deformation of the present surface.

This paper was read in abstract by C. D. Walcott and was illustrated by cross-sections. It involved a great amount of detail, however, which it is not possible to summarize, but which will be extremely valuable as a matter of record. At its conclusion the morning session adjourned. On reassembling the first paper read was the following:

The Tuff Cone at Diamond Head: C. H. HITCHCOCK, Hanover, N. H.

This cone is one of the famous ones of the Hawaiian Islands, and is interesting and exceptional in that coral, limestone and marine shells are copiously mingled with the tuffs, giving rise to a difference of opinion as to whether the cone is submarine and therefore marks a notable subsequent elevation of the land, or whether the organic remains have been ejected to their present positions along with the tuffs. No discussion followed, as the Fellows seemed too unfamiliar with the locality to hazard an opinion.

An Hypothesis to account for the Extra-Glacial, Abandoned Valleys of the Ohio Basin: MARIUS R. CAMPBELL, Washington, D. C.

The lower courses of the Allegheny, Monongahela, Kanawha, Guyandot, Big Sandy and Kentucky rivers are characterized by abandoned channels which generally range from 100 to 200 feet above the present streams. Generally these channels are deeply covered with silt, but sometimes the rock floor is only partially obscured by a thin layer of sand and gravel. The streams which have forsaken these valleys have sought new routes, along which they have carved deep channels through the upland topography. Teays Valley in West Virginia is perhaps the most noted example, but the old channels at Carmichael and Masontown on the Monongahela River and at Parker on the Allegheny River are also well known.

No reason has been assigned for the abandonment of these channels; they can not be considered as 'ox-bows,' and they are all beyond the limit of glacial ice. The present hypothesis seeks to explain them through the breaking up of river ice and the formation of local ice dams, which were of sufficient height to force the water over the lowest divide in the rim of the basin and which persisted long enough for the stream to intrench itself in its new position.

The paper was illustrated by many lantern slides of topographical maps. It brought on an extended discussion, because the Fellows were generally familiar with the subject, since for many years Teays Valley has not been omitted at a meeting, but has come up in one connection or another, and has grown to be a sort of geological Banquo's ghost, that will not down. I. C. White opposed the ice jams and argued in favor of one large dam produced by the continental glacier when it crossed the Ohio river. He emphasized the softness of the rocks at the headwaters of the southern tributaries and the harder ones further down. W. M. Davis suggested lakes as a possible obstruction which had developed cut-offs by gradually falling waters. G. K. Gilbert opposed the explanation by means of a glacial dam, and suggested a possible change in climate, with increasing cold and a filling of the valleys with ice, which brought about a rearrangement of the drainage. M. R. Campbell opposed the explanation by lakes and by a glacial dam, because of the lack of uniformity in the sedimentation which should appear with such an extended cause. A. P. Brigham called attention to the fact that the new courses assumed by some of the rivers were longer than the old and raised the point that ice jams ought to cut off and shorten meanders. M. R. Campbell admitted the slightly longer courses in a few cases, but still supported the ice jam as against all the other causes suggested.

The Alleged Parker Channel: EDWARD H. WILLIAMS, Jr., Bethlehem, Pa.

The paper was a brief one, which described one of the cases cited by Mr. Campbell, located at Parker, Pa. Instead of an old channel, the apparently abandoned detour of the Allegheny river was explained by the disappearance or effacement of the divide between the headwaters of two tributary streams.

This general subject having been so well gone over, the above paper was not specially discussed.

Apparent Unconformities during Periods of Continuous Sedimentation: GEORGE B. SHATTUCK, Baltimore, Md.

The paper was based on certain phenomena which the author had observed along the shores of Chesapeake Bay. Lenticular beds of black clay were found resting with apparent unconformity on older sediments and provided with cypress knees and other fossilized vegetation. The explanation advanced was that minor stream valleys had been ponded during subsidence of the shore by bars formed across their mouths. Thus, while the sea crept inland and formed extended sediments, these ponded embay-

ments would be the place for the gathering of clays and vegetation which would lie unconformably with the synchronous shore deposits. The paper was very clearly presented and was suitably illustrated by the lantern.

Origin and Age of an Adirondack Augite Syenite: H. P. CUSHING, Cleveland, Ohio.

Recent work in the field, together with chemical analyses, demonstrates that the Adirondack anorthosite shows a certain amount of differentiation and passes locally into an augite syenite, all intermediate phases being found, as was contended by the writer in a paper read before the Society two years ago. There is, however, much evidence now at hand to show that much of the great body of augite syenite gneiss in the Adirondacks is older and to be referred in age to the main body of gneiss of the region, whatever that may be. Criteria for distinguishing between the two syenites have not been developed. The paper was presented by permission of the State Geologist, and was illustrated by an extensive series of analyses. J. F. Kemp remarked the abundance of related rocks in the regions to the south, and then the session adjourned for the day.

In the evening the annual dinner was held, with Professor Emerson in the chair and fifty-five present. An address of welcome to the Society was made on behalf of the Regents of the University by Dr. T. Guilford Smith. The proposition for the erection of a State museum in which to house the collections of the various scientific departments was discussed, and resulted in a subsequent resolution which will be given below.

On Friday morning the Society met at 9:30 and listened to a report of the Committee on Photographs by its chairman, N. H. Darton. The collection now numbers over 2,000, and is stored in the building of the U. S. Geological Survey in Washington. It is a valuable one, and will be revised and condensed, and a published list will be prepared at an early date. This collection has made accessible to the Fellows many photographs made by surveys, both State and national, and by private individuals.

The Laurentian Limestones of Baffinland: ROBERT BELL, Ottawa, Canada.

The discovery of great quantities of crystalline limestones in Baffinland was announced in the writer's 'Summary Report for 1897.' The geographical position and physical aspect of the region were described. The general character of the Laurentian System in Hudson Straits was outlined. The rocks of the north side are newer or Upper Laurentian, as far as known, and differ from those of the south shore. Regularity of strike and dip is pronounced. Enormous developments of crystalline limestones have been met in southern Baffinland. Their general characters were described. Great thickness is presented by the beds, some of them being over a mile across and running regularly for long distances. They are evidently stratified aqueous deposits. Questions were raised as to the origin of such limestones. The associated rocks are gneisses and schists, and the accompanying minerals are chiefly feldspar. Owing to the absence of trees, the limestones are conspicuous in the landscape and are not more eroded than the gneisses. Comparisons were drawn with Laurentian limestones elsewhere, the former physical conditions and the older and newer glaciations of Baffinland were discussed as affecting the limestones. The existing glaciers there were described. The paper was illustrated by the lantern. There was no discussion.

JAMES F. KEMP.

(To be concluded.)